Information Bulletin

Grade 9 Science 1996-97

Students First!
Student Evaluation

Alberta EDUCATION

This document was written primarily for:

Students	✓
Teachers	✓
Administrators	✓
Parents	
General Audience	
Others (Specify)	✓ Superintendents

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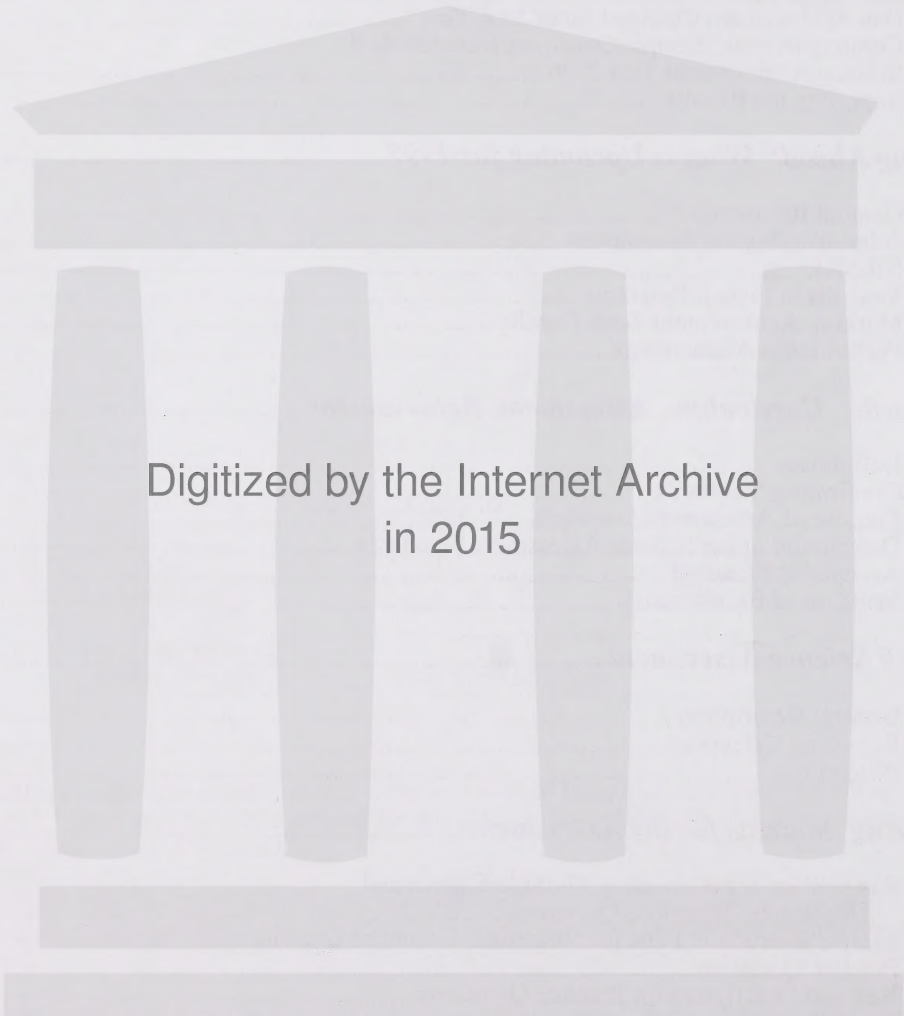
This bulletin contains general information about the Provincial Student Assessment Program and information specific to the Grade 9 Science Achievement Test. **It replaces all previous bulletins.**

October 1996

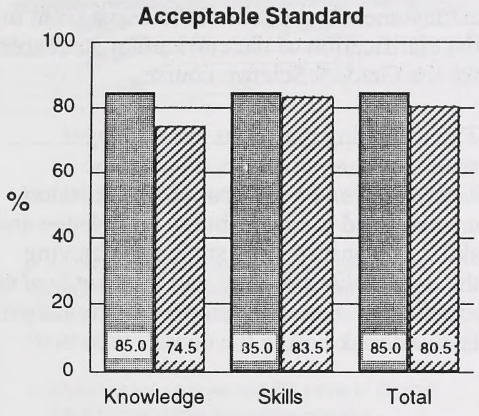
Contents

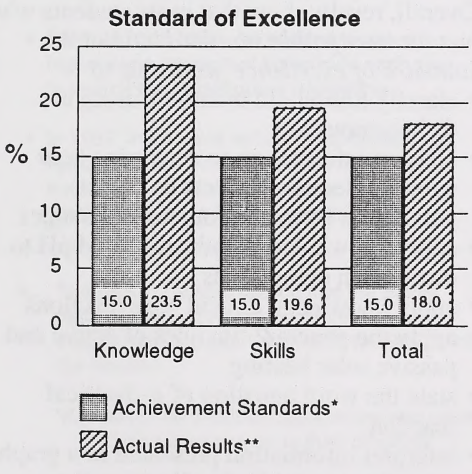


Looking Back: Highlights of 1996

Grade 9 Science

This information provides teachers, school administrators, and the public with an overview of the results for the June 1996 Grade 9 Science provincial assessment. It complements the detailed school and jurisdiction reports.





*the percentage of students in the province expected to meet the acceptable standard and the standard of excellence

**the percentage of students in the province who met the standards (based on those who wrote)

Who Wrote the Test?

All students registered in Grade 9 were expected to write the 1996 Science assessment. A total of 33 908 students completed the June 1996 assessment. In 1996, only a small proportion of students in Grade 9 did not write the test: 4.7% of students were absent and 3.2% of students were excused from writing by their superintendent.

What Was the Test Like?

The assessment instrument had 50 multiple-choice questions and 5 numerical-response questions in six topic areas: Diversity of Living Things, Heat Energy: Transfer and Conservation, Fluids and Pressure, Electromagnetic Systems, Chemical Properties and Changes, and Environmental Quality. Two learning domains were assessed: Knowledge (19 questions) and Skills (36 questions). Students recorded their responses to questions on a separate answer sheet.

How Well Did Students Do?

As shown by the graphs, the number of students meeting the *acceptable standard* is below expectations. This is discouraging, particularly on the knowledge component of the test, where only 74.5% of students were able to meet the *acceptable standard*. However, the number of students achieving the *standard of excellence* is higher than expected in both the knowledge and skills components of the test.

In 7.0% of the schools, the percentage of students meeting the *acceptable standard*

was significantly above expectations for the province. In 65.3% of the schools, the percentage was not significantly different from provincial expectations. In 27.7% of schools, the percentage of students meeting the *acceptable standard* was significantly below provincial expectations. Schools where fewer than five students wrote the Grade 9 test are not included in these school calculations.

The results presented in this material are based on scores achieved by all students except those who wrote the French translation of the test. Results for these students are reported separately.

Has Achievement Changed Since Last Year?

A comparison of the results on the common items appearing on both the 1995 and 1996 tests shows that student achievement has increased very slightly. In 1995, the provincial average on the 35 common items was 22.0. In 1996, the provincial average on the 35 common items was 22.6.

Commentary and Sample Questions from Grade 9 Science Achievement Test 1996

Unfortunately question 4 was dropped from the test. An error in the placement of the line on one of the graphs was made. This, in turn, generated an answer for question 4 that was not one of the multiple-choice alternatives.

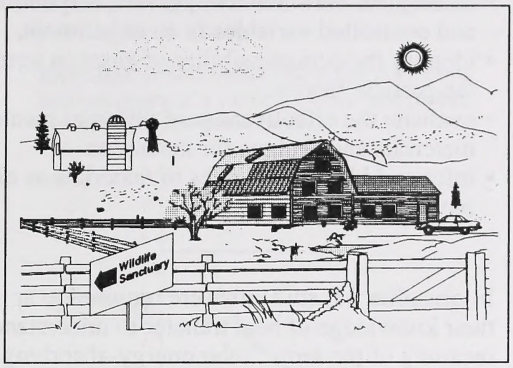
The Grade 9 teachers who reviewed the assessment felt that it adequately covered both concepts and process skills in all six units, that it was a good reflection of the science program, and the emphasis on the test reflects what is being taught in most classrooms. The majority of teachers believe that the test had a good range of comprehension questions with an excellent representation of all the areas of the program. Some of the teachers felt that the assessment would be more meaningful if more emphasis could be placed on providing a real-life context where students would take on a role in the question. Teachers continue to agree that numerical-response questions can provide more relevant information about what students can do with what they know in science. The use of the numerical-response format, with clear directions for students will continue. Many teachers indicated that the achievement test continues to assist them in the clarification of the curriculum standards for the Grade 9 Science course.

The following questions are no longer secured. Sample questions from the assessment and accompanying discussion are provided to highlight the knowledge and skills demonstrated by students achieving the *acceptable standard* and the *standard of excellence*. For each sample question, there is an asterisk beside the correct answer.

Acceptable Standard

Overall, results show that most students who met the *acceptable standard* but not the *standard of excellence* were able to

- classify household materials using a dichotomous key
- nterpret information to determine how natural selection protects an insect population from environmental changes
- apply knowledge of indicators and pH to distinguish compounds
- apply knowledge of acid base reactions
- apply the general principles of active and passive solar heating
- state the word equation of a chemical reaction
- interpret information presented in a graph related to the acid rain effects on the environment
- recognize evidence of chemical change
- interpret information on magnification of a pollutant in a food chain
- evaluate alternatives regarding actions that may affect environments
- predict the effect of thermal pollution on the health of trout in a lake
- recognize the consequences of environmental changes due to human activities



Use the following information to answer question 6.

A neighbouring farmer shows Mr. Brown the careful records he has kept over the past 20 years of different insect populations on his farm. He observes that:

- Many insect species exhibit several distinct adult forms within the same species (polymorphism). He noted that each form has adapted for a particular function.
- From 1976 to 1989, he needed to use a higher concentration of insecticide each year to control the grasshopper population.
- In 1987, there were aphids in his clover crop. Aphids are tiny insects that use the juices from plants for food. Frequently, aphids cause a reduction in plant growth.

6. The **most** probable reason that the farmer needed to use a higher concentration of insecticide each year from 1976 to 1989 is that the insects

***A.** survived previous applications and passed their resistance on to their offspring

B. reproduced quickly enough to replace those killed by the insecticide

C. increased in size and weight

D. were not affected by the insecticide because it was absorbed into the soil, water, and air

- interpret a graph to select pH levels in a river suitable for an organism
- evaluate alternatives in experimental design for further environmental research
- predict the effect on temperature caused by a resistor in a circuit
- apply knowledge that a simple wet cell converts chemical energy to electrical energy
- predict the effects of incomplete circuits in parallel and series circuits

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In **question 6**, students were required to read through each of the observations that a farmer had made in relation to insect populations on his farm. Students had to make a decision about which of the observations would be relevant in assisting them to select the most probable reason for the farmer's need to use a higher concentration of insecticide each year. More than 78% of students achieving the *acceptable standard* were able to answer this question correctly. Although for some students the answer may be one they could have recalled from previous knowledge, for many students the sorting of relevant information to assist them in arriving at a correct solution, would not have been an easy task.

Many students achieving the *acceptable standard* but not the *standard of excellence* experienced difficulty in correctly answering questions that required them to

- apply the meaning of polymorphism
- interpret, from information, the specific variables in an experiment
- identify the function of a heat storage tank in a solar heated home
- calculate density of a material based on mass and water displacement
- interpret data to identify factors in an environment that might affect the health and distribution of living things
- identify components within wastes that have known negative effects
- interpret the operation of various kinds of valves
- apply knowledge that electricity is generated by movement of a magnet through a coil

Use the following information to answer question 11.

Mr. and Mrs. Brown decide to make curtains out of material that will make the house more energy efficient. They experiment to determine the best solar energy-absorbing material. They note the following variables:

I. time of day
II. type of material
III. length of time in the sunlight
IV. surface area exposed to sunlight

11. The variables that should be kept **constant** in this experiment are

A. I and II
B. II and IV
***C.** I, III, and IV
D. II, III, and IV

- distinguish between manipulated, responding, and controlled variables in an experiment.
- identify the compressibility of gases in terms of the particle theory
- evaluate the effectiveness of different insulating materials and designs for insulation
- infer and identify changes in materials as either physical or chemical

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In **question 11**, students were required to apply their knowledge of heat transfer to understand the meaning of the term "solar energy-absorbing material." Next, students had to note four variables related to the experiment and then answer the question by identifying the variables that should be kept constant. Only 57% of students achieving the *acceptable standard* were able to answer this question correctly. Many students continue to have difficulty identifying variables in an experiment, that either have to be held constant, manipulated, or those that are responding variables.

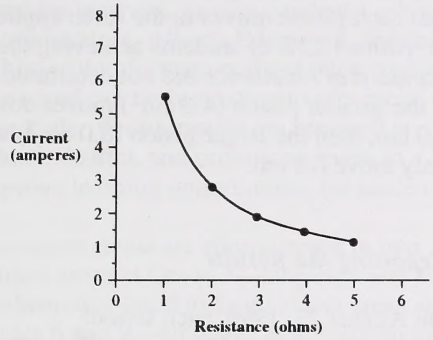
Standard of Excellence

Students who met the *standard of excellence* demonstrated greater success than did other students. In addition to the successes identified for students achieving the *acceptable standard*, many students achieving the *standard of excellence*, specifically, could

- transfer and apply the meaning of species
- apply knowledge of the negative impact of chemical use on the environment
- apply knowledge of the purpose of a thermocouple
- interpret the relationship between viscosity and temperature in a practical application
- apply information of abiotic factors in an environment that might affect the health and distribution of an organism
- infer, from given information, the fertilizer that produces the highest yield of wheat
- identify applications of heat conduction
- apply knowledge that light and heat energy can be produced when electricity is passed through a resistor
- interpret information showing the relationship between current and resistance

Use the following information to answer question 44.

Amandeep used a multimeter to test the current and resistance of a variable resistor and plotted the results on the graph below.



44. The graph shows that current

- ***A.** increases when resistance decreases
- **B.** decreases when resistance decreases
- **C.** increases when resistance increases
- **D.** doubles when resistance increases

- predict the flow pattern of a liquid as it is heated
- measure the relative density of liquids using a hydrometer

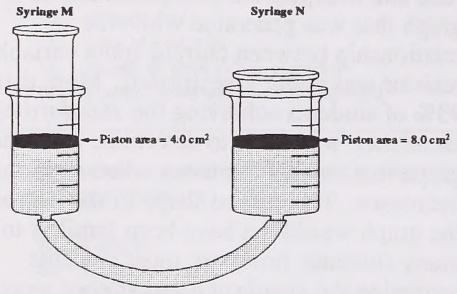
In **question 44**, students were required to read and interpret the data presented on a graph that was generated while the relationship between current and a variable resistor was being investigated. More than 93% of students achieving the *standard of excellence* were able to determine from the graph that current increases when resistance decreases. The curved shape of the line on the graph would not have been familiar to many students; however, most students achieving the *standard of excellence* were successful in their interpretation of the relationship between current and resistance.

Many students achieving the *standard of excellence* experienced some difficulty in correctly answering questions that required them to

- recognize that changes in reaction rates can cause an explosive reaction
- apply knowledge of the relationship between pressure, force, area, and distance in a hydraulic system
- make inferences based on evidence gathered from observing chemical reactions
- predict a circuit connection from results of circuit tests
- judge the effects of heat transfer between solids and liquids
- interpret specific information about the contribution of research from scientific knowledge

Use the following information to answer question 19.

Mrs. Brown makes a model to learn how fluid pressure affects the car's brake system. She joins two syringes with a hose, as shown in the diagram. The surface area of the large piston is twice the surface area of the small piston.



19. If the system is full of fluid and the piston in syringe **M** is pushed down 1.0 cm, the piston in syringe **N** will go up

*A. 0.5 cm
B. 1.0 cm
C. 1.5 cm
D. 2.0 cm

In **question 19**, students were required to link their knowledge of hydraulic systems to the relationship that exists between pressure, force, and area within a confined fluid. In addition, they had to apply this understanding to a new relationship that related the distance that each piston moves to the force applied to it. Almost 22% of students achieving the *standard of excellence* did not determine that if the smaller piston (4.0 cm^2) moves down 1.0 cm, then the larger piston (8.0 cm^2) will only move 0.5 cm.

Reporting the Results

On August 23, 1996, each school jurisdiction received electronically, a district report and individual school reports regarding their students' achievement, as well as guidelines for interpreting these results in relation to provincial standards.

To facilitate reflection on school programs, we expect that results will be shared with all school staff (not just teachers of grades 3, 6, and 9), as well as with parents and the community.

Two copies of an individual profile for each student were sent to the school that the student will attend in September. We expect that the Parent Copy be shared with parents and the School Copy will remain with the student's record.

All Achievement Tests administered in 1993 and prior to 1993 are no longer secured.

Looking Ahead: What is Upcoming for 1997

General Information

The Provincial Student Assessment Program provides teachers, parents, students, school administrators, Alberta Education, and the public with information about what students know and can do in relation to provincial standards. Group results are reported at school, district, and provincial levels to improve learning opportunities for students.

The assessments are administered in two subject areas at Grade 3—language arts and mathematics—and in four subject areas at grades 6 and 9—language arts, mathematics, social studies, and science.

The assessments are based on provincial standards, which reflect important learnings in the subject areas listed above. Classroom teachers from across the province are extensively involved in developing and field testing the assessment instruments.

Administering the Assessment

Information about the nature of the provincial assessments as well as their administration to special needs students can be found in the *General Information Bulletin, Provincial Student Assessment Program,* which is mailed each fall to all superintendents and principals.

Schedule

The written-response component of English and French Language Arts will be administered during the last week of May. The machine-scorable component of all achievement tests will be administered during the last two weeks of June. Specific information regarding scheduling is provided in the current *General Information Bulletin, Provincial Student Assessment Program.*

To minimize any risks to security, we recommend that all students complete the test on the same day. Superintendents approve a local schedule for achievement test administration within the dates provided. Students who are absent when the tests are administered and who return to school by the end of the school year must write the tests upon their return. By scheduling the tests early in the administration period most, if not all, absentees can be tested upon their return to school. The principal is responsible for ensuring the security of the tests.

The tests that will be administered each year are:

Grade 3
English Language Arts (*Part A: Writing* and *Part B: Reading*)
Mathematics (English and French forms)

Grade 6
English Language Arts (*Part A: Writing* and *Part B: Reading*)
Français 6e année (*Partie A: Production écrite* and *Partie B: Lecture*)
Mathematics (English and French forms)
Science (English and French forms)* see p. 8
Social Studies (English and French forms)

Grade 9
English Language Arts (*Part A: Writing* and *Part B: Reading*)
Français 9e année (*Partie A: Production écrite* and *Partie B: Lecture*)
Mathematics (English and French forms)
Science (English and French forms)
Social Studies (English and French forms)

Students in French Programs

All students in French programs must write English Language Arts, French Language Arts, and French versions of other achievement tests if their language of instruction is French. Alberta Education will send a checklist to schools in January requesting an indication of how many

English or French tests are required. These forms must be returned through jurisdiction offices by mid-February.

* Resources for the implementation of the revised Program of Studies for elementary science will not be available until the 1997–98 school year. Therefore, implementation of the revised Program of Studies for students in French programs is optional for the 1996–97 school year. Schools offering grade 6 science in French must decide which form of the science test they will write in June 1997. The choices are either the translated form of the 1996 Grade 6 Science Achievement Test based on the previous program or the 1997 Grade 6 Science Achievement Test based on the revised program. Schools offering Grade 6 Science in French must choose one form or the other for all students in Grade 6 writing in French.

Marking Achievement Tests Locally

Teachers are able to mark the tests before returning them to Alberta Education. Teachers can use the results as part of an individual student's year end assessment, as well as for planning instruction.

Provincial results for each subject and grade appear at the beginning of each subject bulletin under the heading "Looking Back: Highlights of 1996."

Performance Assessments

Performance assessments provide students with real-life tasks. These assessments address many of the learner expectations that cannot be easily measured using only paper and pencil strategies. These tasks have been developed by classroom teachers and are designed to model good classroom instruction and assessment practices.

The Student Evaluation Branch uses these tasks to collect a broader base of information about what students know and can do than achievement tests alone can provide. These assessments will be administered to a provincial sample of students in all subjects on a rotating basis. The following assessments will be given in 1997:

Grade 3
- informational book tasks in language arts

Grade 6
- social studies: inquiry into basic needs

Grade 9
- problem-solving and communication tasks in science

Standards: Curriculum, Assessment, Achievement

The move toward results-based curricula has re-emphasized the need for a clear delineation of standards and their purpose. All standards and all methods of setting standards require judgement. Local targets are also dicussed in this section.

> The process of setting a standard can only be as good as the judgements that go into it. The standard will depend on whose judgements are involved in the process. In this sense, all standards are subjective. Yet once a standard has been set, the decisions based on it can be made objectively. Instead of a separate set of judgements for each test-taker, you will have the same set of judgements applied to all test-takers. Standards cannot be objectively determined, but they can be objectively applied.[1]

Definitions

The Achievement Testing Program is directly concerned with three different but related standards. These provincial standards are curriculum standards, assessment standards, and achievement standards.

- **Curriculum Standards** are the expected student learnings sequenced into grade levels. They include broad statements of knowledge, skills and attitude expectations against which student performance is judged. These standards are established in the process of curriculum development and are found in the *Program of Studies* document produced for each subject.

- **Assessment Standards** are the criteria adopted for judging actual student achievement relative to curriculum standards. They are ultimately expressed and applied to test scores. They are derived from answers to questions such as: What scores must a student obtain or how many questions on a given test must a student answer correctly in order for his/her performance on the test to be judged as acceptable or excellent? For the Achievement Testing Program the provincial assessment standards are 80% for the *standard of excellence* and 50% for the *acceptable standard.*

- **Achievement Standards** are judgements that specify what percentages of students are expected to achieve an acceptable and an excellent level of performance in relation to each course of studies, i.e., the relevant curriculum standards. It is important to point out that this judgement is not a prediction of the percentage of students who will actually achieve acceptable or excellent levels of performance, but rather a specification of the percentage of students at a given grade or year in school who are *expected* to achieve the acceptable (85%) or excellent standard (15%). **The 85% of students expected to meet the *acceptable standard* includes those students who meet the *standard of excellence*.** These standards apply to school, jurisdiction, and provincial performance.

- **Local targets** are goals set in schools/districts to focus plans for helping students learn what is expected by the provincial government. These local targets reflect the specific needs of students, the views of teachers, school administration, and the local community, and the resources available to provide learning opportunities for students.

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[1] Passing Scores; Samuel A. Livingston, Michael J. Zieky; Educational Testing Service, 1982.

Confirming Standards

Confirming standards is a process in which some teachers who are selected for marking are asked to make judgements about the achievement test to answer the question of whether province-wide performance is good enough. For more information on the confirming standards process, refer to the *Provincial Student Assessment Program Provincial Report, June 1993 Administration*. For information on the selection of teachers for participation in the confirming standards process, refer to the current *General Information Bulletin, Provincial Student Assessment Program.*

Purpose of Assessment Standards

The provincial standards are the basis upon which we assess how well students have learned science by the end of Grade 9. These standards reflect the essential learnings that all Alberta students are expected to achieve. Provincial Standards are useful, therefore, for assessing Grade 9 students in all types of school programs—public, private, and home education. By comparing actual results to provincial standards, decisions can be made about whether achievement is in fact "good enough."

Description of the Science Assessment Standards

The following statements describe what is expected of Grade 9 students who are meeting the *acceptable standard* or the *standard of excellence* on independent work at the end of the Grade 9 Science program. The statements represent the standards against which student achievement will be measured.

Acceptable Standard

For students to meet the *acceptable standard* of performance in Grade 9 Science, they are expected to have a basic understanding of the conceptual and procedural knowledge that is essential to the Junior High science program. For example, they can easily apply concepts and basic procedures in simple and familiar situations in which they have had previous experience, but they are challenged when applying these concepts and procedures to unfamiliar or complex situations. Students may be able to identify the name of an organism in a classification system, for example, but have difficulty interpreting the relationship of organisms at the same classification level.

To meet the *acceptable standard*, students are expected to know how to apply higher level thinking skills in familiar situations. However, students may have difficulty applying these skills in new or unfamiliar situations. For example, they can predict the effects of linking a familiar and identical electrical load in series or parallel circuit, but may have difficulty predicting the effects of linking different or unfamiliar types of electrical loads in these circuits. They can use basic skills to show what they know and can do in novel real-life problems that are simple or that require single-step solutions. Also, they can apply more advanced skills or follow multistep procedures to solve familiar real-life problems in which they have had prior experience. For example, in a problem-solving activity to find the best insulating material, these students will be able to develop a simple and controlled procedure, collect a set of data, and determine the best insulator. However, their procedures will likely not have more than one manipulated variable and may lack a complete and logical explanation of results.

Students who meet the *acceptable* level of performance generally have a positive attitude toward learning about the world in which they live. They appreciate how science and technology affect them on a day-to-day basis. They are skilled in using the basic procedures of science inquiry, technological problem-solving, and societal decision-making; however, they have difficulty with the application of more

advanced skills and have limited ability to make connections between science, technology, and society.

Standard of Excellence

Most students who meet the *standard of excellence* in Grade 9 Science have an exceptional understanding of the conceptual and procedural knowledge outlined in the *Program of Studies*. They can quickly and confidently apply this knowledge in complex and novel situations. For example, not only can they identify the abiotic factors that affect the health and distribution of living things, they also can predict the possible outcomes of changing abiotic factors on living things and evaluate their effects on the quality of the environment.

These students are expected to be able to apply higher-level thinking skills to unfamiliar situations. In addition, they can easily and quickly solve problems that they have direct experience with and that require single-step or multistep solutions. These students can solve a problem in more than one way and can see more than one solution for some problems. For example, not only are they familiar with the basic operation of an electric motor, but they can troubleshoot an inoperative motor, make design changes to meet varying performance criteria, and construct a working motor. Their problem-solving approach may involve more than one manipulated variable and include logical explanations of procedures and results.

Students meeting the *standard of excellence* have a positive attitude about science and its role in their world. They are curious, open-minded, creative, and confident. In addition, they are persistent problem-solvers and have the ability to view a situation from a number of perspectives. Not only do they have a high level of awareness and understanding of how science and technology affect them personally, they can translate this understanding and awareness to societal issues. They are skilled in using the basic procedures of science inquiry, technological problem solving, and societal decision making. They can successfully use advanced skills and make connections between science, technology, and society.

Grade 9 Science Assessment

General Description

The Grade 9 Science test consists of 55 machine-scored questions: 50 multiple-choice questions each with a value of one mark and 5 numerical-response questions each with a value of one mark. The five numerical-response questions are integrated with the multiple-choice questions throughout the test.

Students record their answers on a separate answer sheet.

The assessment is designed to be completed in 75 minutes. However, additional time of up to 30 minutes may be provided to allow students to finish. We suggest that those students who finish writing before one hour has elapsed remain at their desks to review their answers.

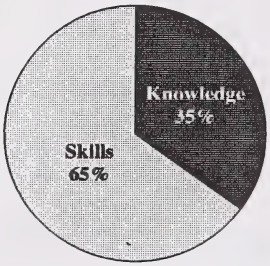
Students will need HB pencils, erasers, and a calculator.

Reporting Categories

This assessment is based on science learnings within which the nature of science, of science and technology, and of science, technology, and society are integrated components.

Knowledge is the fundamental understanding of concepts and processes of science. Skills refer to the application of knowledge.

The weighting for each of these reporting categories is shown in the following circle graph:



The skills reporting category consists of:

- inquiry skills
- technological problem-solving skills
- societal decision-making skills

The knowledge reporting category includes content from

Diversity of Living Things
Fluids and Pressure
Heat Energy: Transfer and Conservation
Electromagnetic Systems
Chemical Properties and Changes
Environmental Quality

Blueprint

The emphasis for each topic and the knowledge and skills reporting categories are presented in the blueprint. The blueprint for the 1997 test will remain the same as it was for the 1996 test.

Blueprint
Grade 9 Science Assessment

Topic	Number of Questions (Percent)	Reporting Category Emphasis *By Number of Questions (Percent)	
		Knowledge	Skills
Diversity of Living Things	10 (18)	4 (7)	6 (11)
Fluids and Pressure	10 (19)	3 (6)	7 (13)
Heat Energy: Transfer and Conservation	7 (13)	3 (6)	4 (7)
Electromagnetic Systems	9 (16)	3 (5)	6 (11)
Chemical Properties and Changes	9 (17)	3 (6)	6 (11)
Environmental Quality	10 (17)	3 (5)	7 (12)
Total	55 (100)	19 (35)	36 (65)

* The number of questions on the test may vary slightly from those indicated in the reporting category.

Preparing Students for the Assessment

We hope that teachers share the following information with their students to help them prepare for the science assessment.

- Talk with your students about some of the positive and negative aspects of taking tests. Share some of your own experiences and have your students share theirs.

- Familiarize your students with the format of the achievement assessment and the kinds of questions that will appear on it by having them work through the sample questions.

Suggestions for Answering Multiple-Choice and Numerical-Response Questions

The questions in the achievement assessment are integrated in real-life contexts. Frequently, a number of questions are clustered around a common context.

- Students should use other information given for answering questions by:

  —reading the information and thinking carefully about it before trying to answer any of the questions that need the information OR

  —reading the questions first and then reading the information, keeping in mind the questions they need to answer

When information is given for more than one question, students should go back to the information before answering each question.

Students must make sure they look at all forms of information given. Information may be given in words, charts, pictures, graphs, and maps.

Students should choose the answer they think is best. If they don't see a correct or best answer right away, they are encouraged to find the two choices that seem closest to the correct answer and pick one of them for the answer.

Sample Instruction Page for Numerical-Response Questions

Instructions:

- Read the question carefully.
- Write your answer in the boxes on the answer sheet, beginning in the left-hand box. Then, carefully fill in the circles that match your answer.
- Ignore the decimal point unless the question indicates otherwise.
- Use only an HB pencil. If you wish to change an answer, **erase** your first answer **completely**.

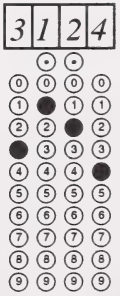
Example

1. Red litmus paper was used to indicate whether four solutions found in a kitchen were acidic or basic. The results are shown in the table below.

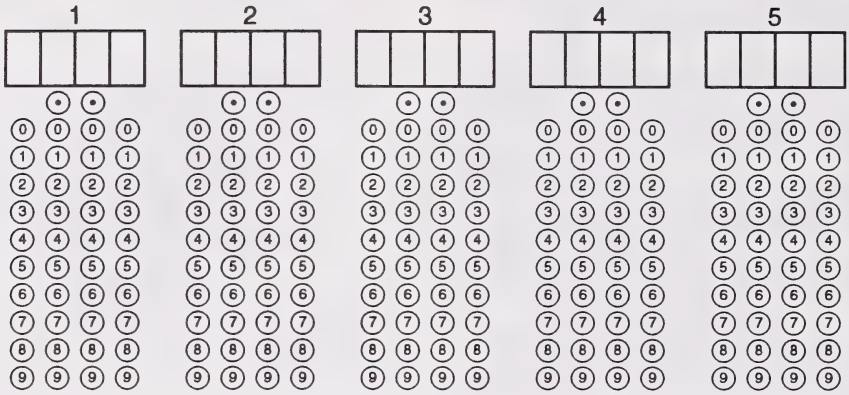
Solution	Colour of Litmus Paper
1	pink
2	no change
3	red
4	blue

Record the order of the solutions from **most** acidic to **most** basic.

Answer: 3 1 2 4



Practice Answer Form for Numerical-Response Questions



Practice Questions

The following practice questions reflect the nature and complexity of the questions that will appear on the Grade 9 Science Achievement Test.

We encourage teachers to familiarize students with the assessment by having them work through these practice questions. A practice answer sheet for the numerical-response questions is provided above so that students can familiarize themselves with this new form. Please note that this collection of practice questions has been used on previous achievement tests and may be used with students. Other items from previous tests remain secured (see *General Information Bulletin*). The questions do not necessarily represent the assessment emphasis as presented in the blueprint.

There are 22 multiple-choice questions and one numerical-response question. The key and descriptors for the practice questions is found on page 32. For further practice with the various types of numerical-response questions, refer to the *1995–96 Grade 9 Science Information Bulletin*.

NEW HOME AND AREA

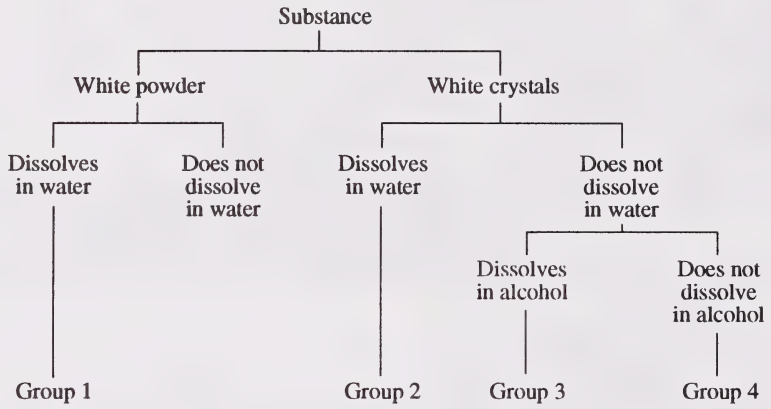
The Brown family purchased a farm that is near a wildlife sanctuary. The next ten questions are about their activities.

1. Kayla Brown visits the wildlife sanctuary. The naturalist describes some unusual species that are protected within the sanctuary. Kayla **correctly** recalls that a species is defined as a group of organisms that

A. live in the same habitat
B. adapt to environmental changes
C. have both exoskeletons and skeletons
D. are able to interbreed and produce young

Use the following information to answer question 2.

Kayla knows that some chemical substances are used in the sanctuary. Kayla saw a poster of a classification system developed by a naturalist to sort substances, in the event that labels are missing.



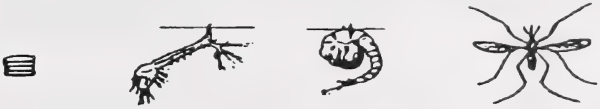
2. After examining the classification system, Kayla determines that salt belongs in group

A. 1
B. 2
C. 3
D. 4

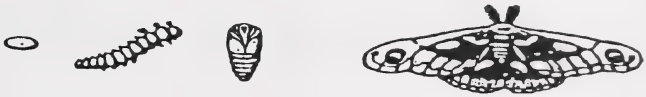
3. Which insect exhibits polymorphism?

A.

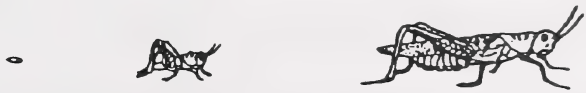
B.



C.



D.



4. Mr. Brown wants to control the aphids at the farm. The **most** environmentally sound **action** he can take is to

A. purchase insect-eating ladybugs and release them in the clover crop
B. apply an insecticide and harvest the crop as quickly as possible
C. apply a herbicide and then plough the crop under and plant again
D. leave the aphids alone because they have a very short lifespan

Use the following information to answer question 5.

A neighbouring farmer shows Mr. Brown the careful records he has kept over the past 20 years of different insect populations on his farm. He observes that:

- Many insect species exhibit several distinct adult forms within the same species (polymorphism). He noted that each form has adapted for a particular function.
- From 1976 to 1989, he needed to use a higher concentration of insecticide each year to control the grasshopper population.
- In 1987, there were aphids in his clover crop. Aphids are tiny insects that use the juices from plants for food. Frequently, aphids cause a reduction in plant growth.

5. The **most** probable reason that the farmer needed to use a higher concentration of insecticide each year from 1976 to 1989 is that the insects

A. survived previous applications and passed their resistance on to their offspring
B. reproduced quickly enough to replace those killed by the insecticide
C. increased in size and weight
D. were not affected by the insecticide because it was absorbed into the soil, water, and air

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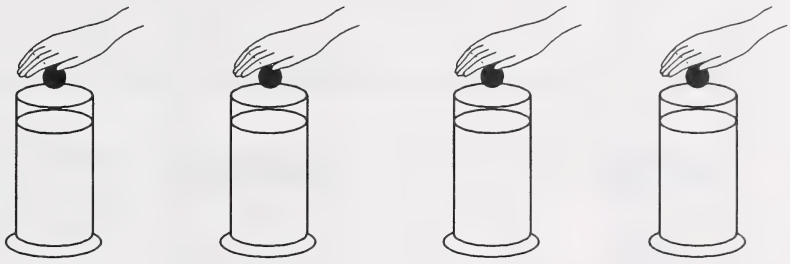
6. Mrs. Brown installs a thermocouple as a safety device on the new home's natural gas furnace. A thermocouple converts

A. electric current into light energy
B. light energy into electric current
C. heat energy into electric current
D. light energy into heat energy

Use the following information to answer questions 7 and 8.

Mrs. Brown finds different grades of oil in the garage. She wants to test the oil to see which grade will be best for their car. To test the oil, she fills each of four 100-mL cylinders with a different grade of oil. The temperature of the oil in each cylinder is 20°C. She drops a marble into each cylinder and times how long it takes for each marble to reach the bottom of the cylinder. She finds that the higher the SAE number, the more viscous the oil.



This table summarizes her data.

Cylinder	Grade of oil	Time (seconds)
W	SAE 10	0.9
X	SAE 20	1.8
Y	SAE 30	1.9
Z	SAE 40	2.4

7. The grade of oil that is **most** suitable for a car that will be driven for a long period of time in very hot weather is

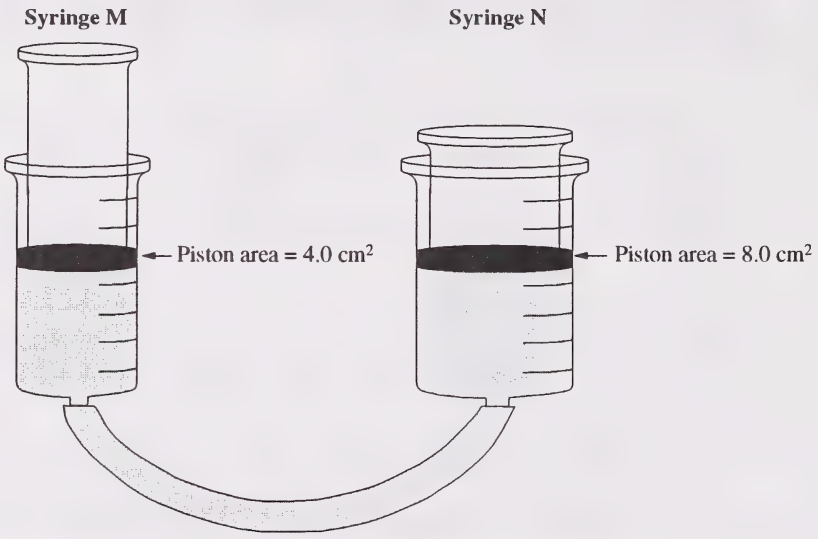
A. SAE 10
B. SAE 20
C. SAE 30
D. SAE 40

8. If Mrs. Brown cools the oil in each cylinder to 10°C, the time it takes each marble to reach the bottom of the cylinder will

A. decrease in all cylinders
B. increase in all cylinders
C. remain the same
D. increase in cylinder Y only

Use the following information to answer question 9.

Mrs. Brown makes a model to learn how fluid pressure affects the car's brake system. She joins two syringes with a hose, as shown in the diagram. The surface area of the large piston is twice the surface area of the small piston.



9. If the system is full of fluid and the piston in syringe **M** is pushed down 1.0 cm, the piston in syringe **N** will go up

A. 0.5 cm
B. 1.0 cm
C. 1.5 cm
D. 2.0 cm

Use the following information to answer question 10.

Mr. and Mrs. Brown decide to make curtains out of material that will make the house more energy efficient. They experiment to determine the best solar energy-absorbing material. They note the following variables:

I. time of day
II. type of material
III. length of time in the sunlight
IV. surface area exposed to sunlight

10. The variables that should be kept **constant** in this experiment are

A. I and II
B. II and IV
C. I, III, and IV
D. II, III, and IV

RESEARCHER

Mai Lee is a researcher who works as a consultant. She performs experiments, tests mineral ores, conducts research on waterways, and writes reports on her findings. The next six questions are about Mai Lee's work.

Use the following information to answer numerical-response question 1.

Mai Lee received four unknown substances delivered from a police laboratory. She tested the substances and her observations were recorded in the table below.

Test	Substance/Procedure	Observations
W	An unknown white powder is added to a known colourless solution.	Rise in temperature; the solution turned deep purple in colour.
X	An unknown colourless solution is added to a known colourless solution.	Rise in temperature; no change in colour; bubbles of gas.
Y	Another unknown white powder is added to a known colourless solution.	No change in temperature; no change in colour; white powder disappears.
Z	An unknown white solid is heated for one minute.	Solid disappears leaving a colourless liquid; after cooling, a white solid appears.

Numerical Response

1. For each test, write **1** if the observed change is **chemical** and write **2** if the observed change is **physical**.

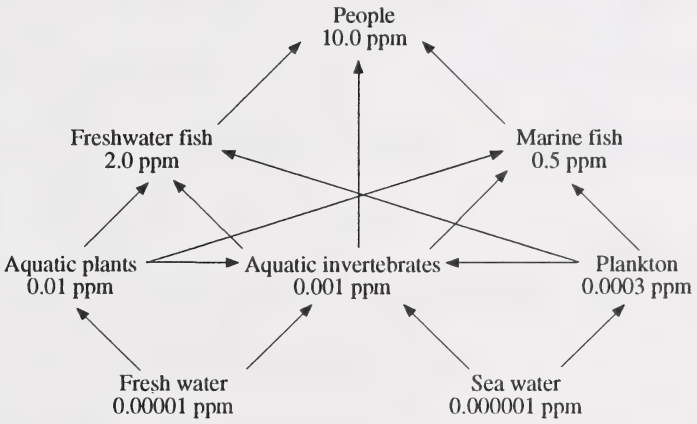
____ W ____ X ____ Y ____ Z

RECORD YOUR ANSWER IN THE NUMERICAL-REPONSE SECTION OF THE ANSWER SHEET

Use the following information to answer question 11.

Mai Lee did research on the levels of a persistent industrial pollutant in different food chains. Mai Lee made the following chart showing a food pyramid.

Chart Showing the Concentration of a Persistent Industrial Pollutant



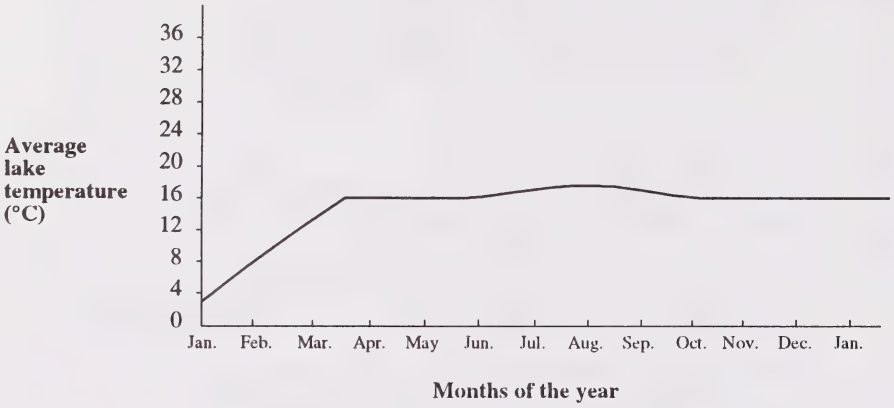
ppm—parts per million

11. The chart shows that the concentration of this industrial pollutant

A. is higher in sea water than it is in fresh water
B. increases with each upward step in the food pyramid
C. decreases with each upward step in the food pyramid
D. is lower in freshwater fish than it is in marine fish

Use the following information to answer question 12.

Mai Lee made notes from a television program that described the issues and problems concerning a newly constructed power plant. The power plant draws water from a small lake to use in its cooling process. The water is returned to the lake 11°C warmer than when it was removed. After opening in March, the new plant had an impact on the average temperature of the lake, as shown in the graph.



The lake is inhabited by a species of trout, which reproduce at temperatures between 0°C and 10°C.

12. A reasonable prediction that Mai Lee can make from the data is that the power plant will

A. cause a decline in the trout population
B. produce large amounts of water at 16°C
C. decrease the food available to trout
D. not affect the temperature of the lake

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13. Mai Lee determined that a local river has a low concentration of dissolved oxygen. This is **most likely** caused by

A. a small population of fish using up oxygen
B. the river water being too cold to absorb oxygen from the air
C. the river water being too turbulent, allowing oxygen to escape
D. decomposers breaking down biological wastes and using up oxygen

14. Through Mai Lee's investigation, a possible relationship between liquid industrial wastes and the growth rate of fish was revealed. To test this hypothesis, Mai Lee should measure the

A. effects of air pollution on spawning
B. rate of fish growth per gram of food
C. growth of fish under controlled conditions of pollution
D. development of fish embryos at various stages of growth

Use the following information to answer question 15.

In a lab, Mai Lee made observations and wrote the following statements:

I. Copper turns green when oxidized.
II. Under normal atmospheric pressure, water changes from a liquid to a gas at 100°C.
III. A 19.3 g mass of gold occupies 1 cm^3.
IV. Sulphur and iron filings are easily separated by a magnet.
V. Sulphur and zinc powder produce an odour and a flame when heated.

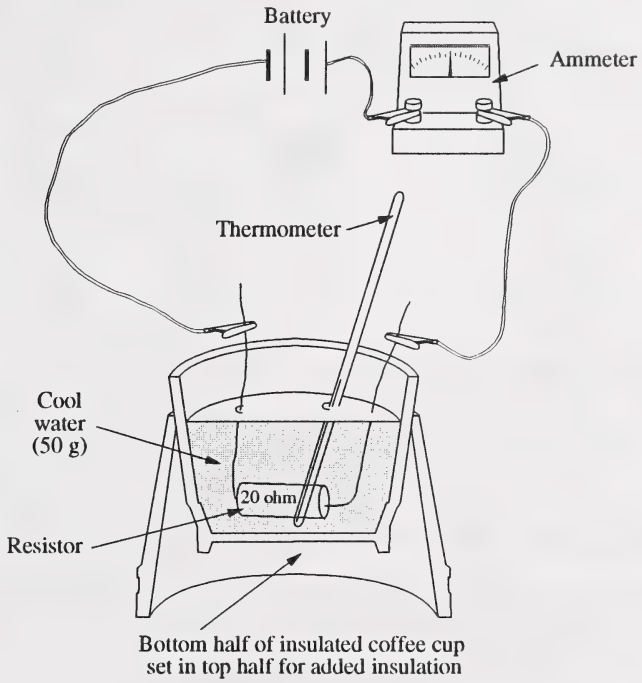
15. The statements that describe a chemical change are

A. I and IV only
B. I and V only
C. I, II, and III
D. I, IV, and V

Students from Graceland Meadows Junior High were assigned to a special project in which they were to investigate the application of science knowledge. To do this, the students performed experiments in the school lab, watched an electrician at work, researched science journals, and toured a factory. The next seven questions are about their experiences.

Use the following information to answer question 16.

Jordan and Amanda set up an experiment to measure the effect of passing an electric current through a resistor immersed in water. They connected a 20-ohm resistor to a circuit, as shown below.

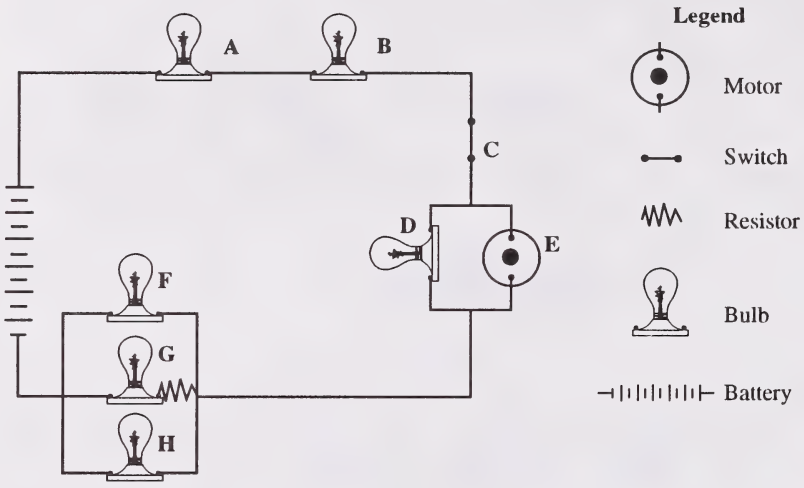


16. Which statement describes what will occur in this experiment?

A. The water temperature will stay the same.
B. The water temperature will rise.
C. The ammeter will burn out.
D. The resistor will glow.

Use the following information to answer question 17.

Yuri, an electrician, showed the students the following diagram of the circuit he was designing for a farm shed.

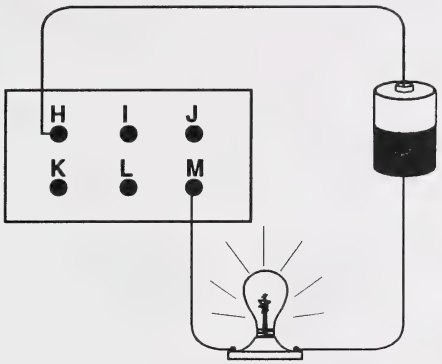


17. What will be the result if bulb **F** is removed from its socket?

A. All other devices will stop working.
B. All other devices will continue to work.
C. Only devices F, G, and H will stop working.
D. Only devices F, G, and H will continue working.

Use the following information to answer question 18.

Michelle found an old rail-switching circuit board that did not have a circuit diagram. When she tested this circuit board using a dry cell and bulb, she obtained the results shown below:



\+ Bulb lights
— Bulb does not light

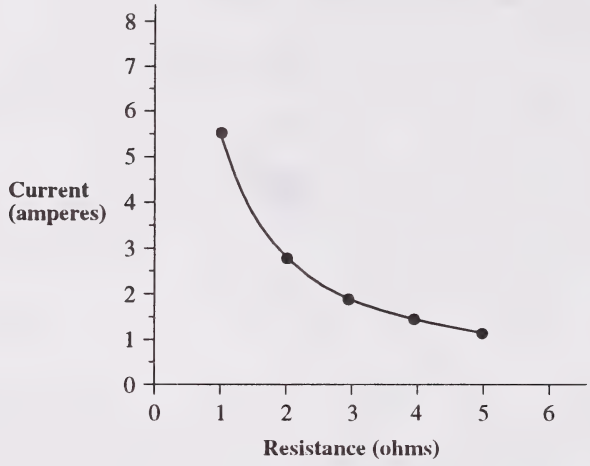
Contacts tested	HI	HJ	HK	HL	HM	IJ	IK	IL	JK	KM	LM
Response of bulb	+	—	+	—	+	—	+	—	—	+	—

18. From this information, Michelle knows that the bulb will also light for connection

A. JM
B. JL
C. IM
D. KL

Use the following information to answer question 19.

Amandeep used a multimeter to test the current and resistance of a variable resistor and plotted the results on the graph below.

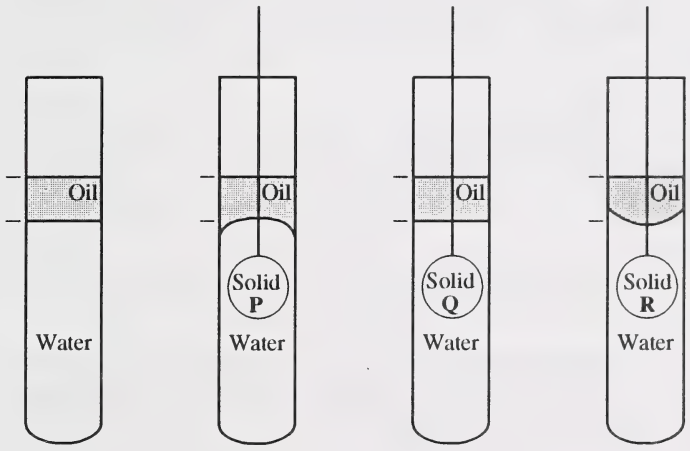


19. The graph shows that current

A. increases when resistance decreases
B. decreases when resistance decreases
C. increases when resistance increases
D. doubles when resistance increases

Use the following information to answer question 20.

In school, Kimberly conducted an experiment to show how a solid at different temperatures affects liquids differently. In calm liquids, she suspended three solids made of the same material. The volume of oil remained the same. Kimberly's results are represented in the diagrams below.



20. Which statement **best** explains the results?

A. Solid R is releasing heat and solid Q is not releasing heat.

B. Solid P is colder than the water and solid R is hotter than the water.

C. Solid Q is at the same temperature as the water, solid P is releasing heat, and solid R is absorbing heat.

D. Solid Q is at the same temperature as the water, but the relative temperatures of solid P and solid R cannot be inferred.

Use the following information to answer question 21.

While investigating applications of science knowledge, Willy learned that scientists have used genetic engineering techniques to attach insulin-producing genes to bacterial DNA. These bacteria produce large amounts of scarce human hormones. Scientists predict that hormones produced by bacteria will be inexpensive and will not cause allergic reactions.

21. Scientists developed hormone-producing bacteria because they wanted to

A. learn about bacteria
B. discover a cure for diseases
C. find a way to increase the supply of hormones for use by humans
D. compare the hormones produced by bacteria with hormones produced naturally

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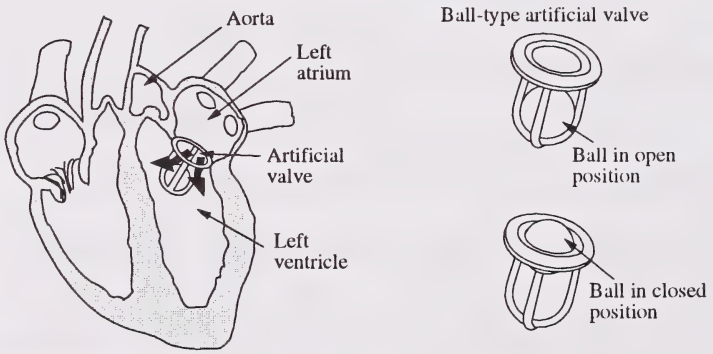
Use the following information to answer question 22.

In her research, Theresa learned that if a person has a heart with a defective valve, an artificial valve can be used to replace the defective valve. This is illustrated below.



22. When the ball of the valve is in the "open" position, blood is

A. forced out of the left ventricle into the aorta
B. supplied by the left atrium to the left ventricle
C. forced out of the left ventricle into the left atrium
D. supplied by the aorta to the left ventricle

Key and Descriptors for Practice Questions

Ques.	Key	Topic	Reporting Category	Curriculum Standard
1	D	Diversity of Living Things	Knowledge	Know the meaning of species
2	B	Diversity of Living Things	Skill	Classify physical and chemical properties of common household materials using a dichotomous key
3	A	Diversity of Living Things	Knowledge	Recognize life forms within a group of insects
4	A	Environmental Quality	Knowledge	Know the negative impact of chemical use on the environment
5	A	Diversity of Living Things	Skill	Interpret information to determine how natural selection protects an insect population from changes in the environment
6	C	Electromagnetic Systems	Knowledge	Know the purpose of a thermocouple
7	D	Fluids and Pressure	Skill	Interpret the relationship between viscosity and temperature
8	B	Fluids and Pressure	Knowledge	Know the effect of temperature changes on the viscosity of fluids
9	A	Fluids and Pressure	Skill	Apply knowledge of the relationship between pressure, force, and area in a hydraulic system
10	C	Heat Energy: Transfer and Conservation	Skill	Interpret the information, specific variables in an experiment
NR1	1122	Chemical Properties and Changes	Skill	Infer and identify changes in materials as physical or chemical
11	B	Environmental Quality	Skill	Interpret information on magnification of a pollutant in a food chain
12	A	Environmental Quality	Skill	Predict the effect of thermal pollution on the health of trout in a lake
13	D	Environmental Quality	Knowledge	Identify components within wastes that have known negative effects on the environment
14	C	Environmental Quality	Skill	Evaluate alternatives in experimental design for further environmental research
15	B	Chemical Properties and Changes	Skill	Recognize evidence of chemical change
16	B	Electromagnetic Systems	Skill	Predict the effect on temperature caused by a resistor in a circuit
17	B	Electromagnetic Systems	Skill	Predict the effects of incomplete circuits in parallel and series
18	C	Electromagnetic Systems	Skill	Predict a circuit connect from results of circuit tests
19	A	Electromagnetic Systems	Skill	Interpret information showing the relationship between current and resistance
20	C	Heat Energy: Transfer and Conservation	Skill	Judge the effects of heat transfer between solids and liquids
21	C	Diversity of Living Things	Knowledge	Interpret specific information about the contribution of research to scientific knowledge
22	B	Fluids and Pressure	Knowledge	Know the operation of valves in the human heart

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